



ContiTech MPD Hoses

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- Overview of API standards
- 2nd Generation of ContiTech MPD Hoses
 - Improvements
 - Prototype Tests
- Services
- Field Records

Overview of API standards

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API 7K

Standard for Drilling and Well service Equipment

- 10 pages for hoses
- ✗ Forbids well effluents and does not address liner compatibility for gases
- ✗ Considers internal pressure loads only
- ✗ For long lines HSE might be compromised
- ✗ Static approach
- ✗ Not approved by third parties

API 17K

Specification of Bonded Flexible Pipe

- Only about hoses - 80 pages
- ✓ Dedicated test ensures liner compatibility for gases
- ✓ Considers combined loading of internal pressure + axial loads + external pressure
- ✓ For long lines design is governed by axial loads and not pressure
- ✓ Dynamic approach with relevant environmental conditions
- ✓ Approved by third parties

Background

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ContiTech has recently developed a new generation of API 17K MPD hose design using the lessons learned by the industry during the previous 4-5 years.

The new design is more superior in numerous aspects, such as:

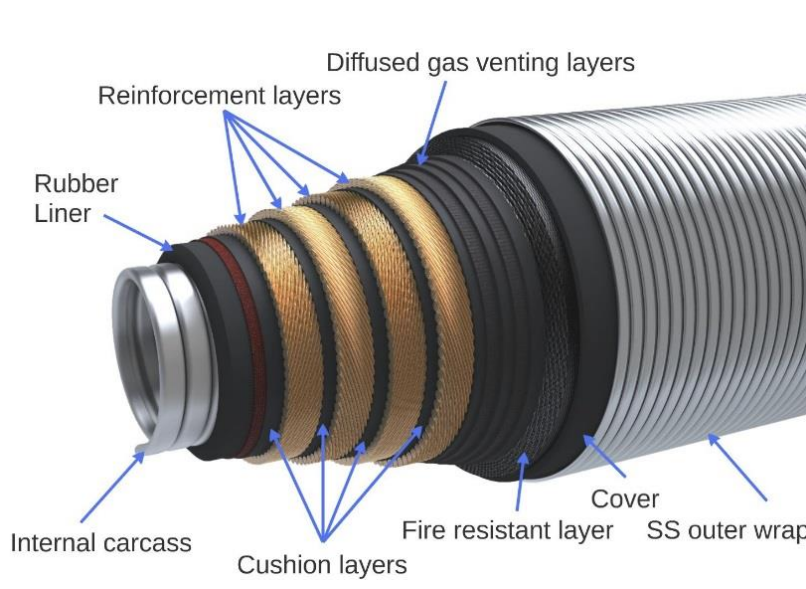
- **weight reduction**
- **increased flexibility**
- **reduced cost**
- **same liner compatibility to abrasive fluid and gases**
- **decreased pressure drop**
- **improved service life**



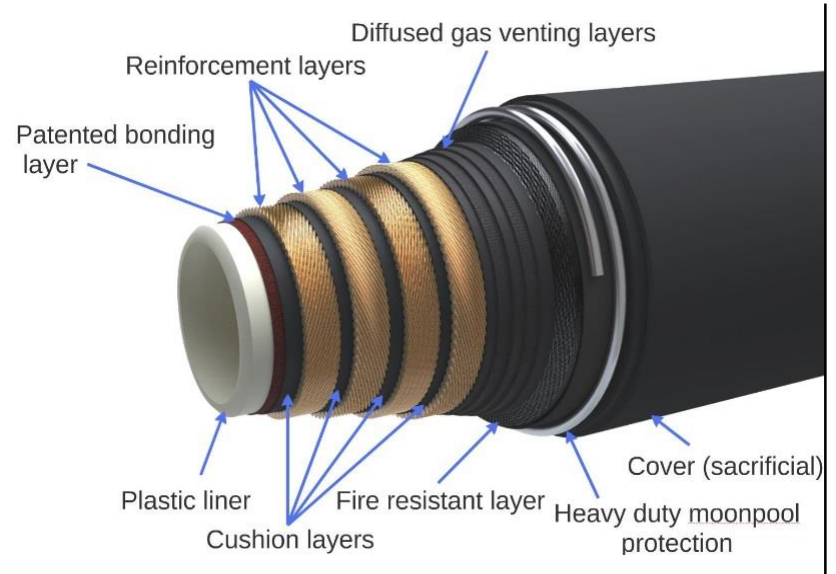
Courtesy of Weatherford

Comparison of hose designs

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Previous API 17K hose design



Enhanced API 17K hose design

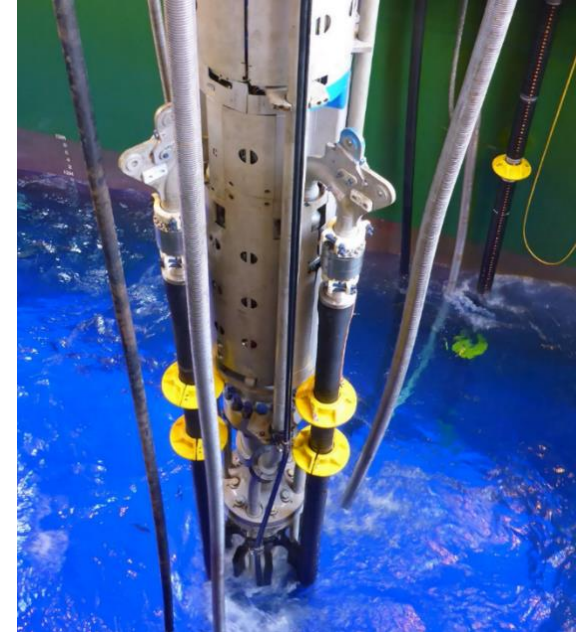
Weight reduction

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40% combined weight savings

- ContiTech **was able to eliminate the innermost layer** of the hose, the internal carcass of the hose **without compromising on the liner compatibility** when it comes to circulating out well effluents. The internal carcass was the most heavy (and costly) layer of the previous hose design.
- The new hose was designed to take 4,000 psi working pressure in 5" and 3,330 psi working pressure in 6". Over the years with the exceptional service history ContiTech hoses have proved that they are not the weakest link of the system, therefore we were able to reduce the initial safety margins added to the working pressure. The 4,000 psi and the 3,330 psi is still well beyond the working pressure limits of the other equipment of the MPD system (RCD, drilling riser).



Courtesy of AF Global

Increased flexibility

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Bending stiffness reduced by 60%

- With eliminating the internal carcass and some of the reinforcement layers, the bending stiffness has been reduced significantly, allowing easier handling, storing and smaller operational MBR.

Reduced costs

- As the most expensive layer, the stainless steel internal carcass was left out, it contributed to cost savings considerably.



Courtesy of Weatherford

- The plastic (PA) liner has the same compatibility to gases as the new design passed the API 17B Full Scale Blistering Test
- The liner has better erosion performance when faced with abrasive fluids (mud cuttings), as
 - The turbulent flow transition is shifted towards higher flow regime without the interlocked internal carcass
 - The plastic liner is thicker and has more erosion allowance

Decreased pressure drop



Pressure drop reduced by 40%

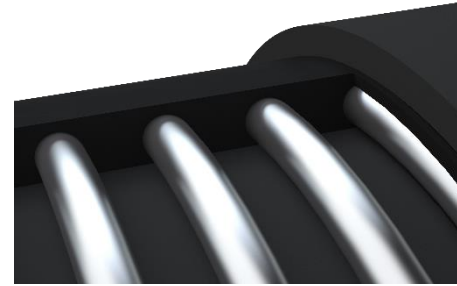
- Eliminating the internal carcass resulted a smooth bore hose, which significantly decreases the pressure drop over the hose line

Improved service life

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Damaged stainless steel wrap



Heavy duty moonpool protection

- In the past numerous failures were experienced on the external cover of hoses equipped with SS wrap shortening their service life and also representing cutting hazard to umbilicals and other equipment
- The heavy duty moonpool protection is a stainless steel helix wrapped around the hose, embedded in rubber and covered with a sacrificial rubber cover
- Even if the rubber cover is abraded and the helix becomes visible, the hose is still perfectly functional as the helix bears no structural loads
- The service life of the hoses is expected to be lengthened as the hose is more resistant to collision to the moonpool, abrasion and rough handling

Lists of all prototype tests performed

API 17K small scale material qualification

API 17K Hydrostatic Pressure Test


Deformation test

API 17K Electrical Continuity Test

API RP 17B Axial Tensile Test

 API RP 17B Full Scale Blistering Test

 API RP 17B Combined Pressure and Tensile Test

 API RP 17B Collapse Test

 API RP 17B Burst Test

GMPHOM MBR Test

Bending Stiffness Test

Full scale blistering test – API 17K & 17B

→ To ensure liner compatibility to well effluents including gases



Simulating rapid gas decompression:
60 decompressions from working to ambient
pressure

Passed – no visible blisters or
delaminations after dissecting

Combined pressure and tensile test – API 17K & 17B

→ To capture combine loading and set an operating envelope



Pressurized to working pressure and applied 150 kN axial loading – exceeding the dynamic loads of a 220 ft hose

Passed – No structural damage

Collapse test – API 17K & 17B

→ To ensure that the hose is not losing stability at operational water depth



While keeping atmospheric pressure inside of the hose, the external pressure is increased up to collapse

Operating envelope **validated up to 400 ft water depth for 5"**

Prototype tests

Burst test – API 17K & 17B

→ To validate pressure containment



Internal pressure is increased until failure

Passed – with a safety factor of 2.75 and the failure was burst on the hose body, not detachment of the end fitting

Services

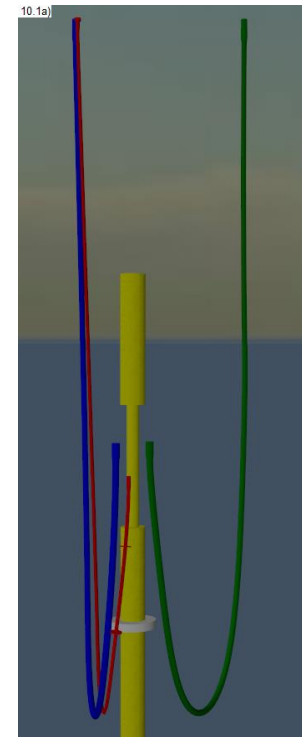
Hose analysis

- Calculating the appropriate hose length, checking the overloading, over twisting the hose
- Work out plastic bumper locations
- Fatigue analysis
- Survival analysis

Hose management

- Recertification of the hoses on-site or off-site (inspection, pressure test)
- Minor hose repair on cover, paints

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MPD Hose reference list

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Offshore Surface Backpressure and Dual Gradient Drilling Systems

Year	Rig Name	System	MPD Hose Standard
2013	Rowan Renaissance	Weatherford	API 17K
	Rowan Resolute	Weatherford	API 17K
	Rowan Reliance	Weatherford	API 17K
	Rowan Relentless	Weatherford	API 17K
2014	Odebrecht Oil & Gas ODN I	AFGlobal / Weatherford	API 17K
	Odebrecht Oil & Gas ODN II	AFGlobal / Weatherford	API 17K
	Odebrecht Oil & Gas Norbe VI	AFGlobal / Weatherford	API 17K
	Odebrecht Oil & Gas ODN Delba III	AFGlobal / Weatherford	API 17K
	Stena Carron	Weatherford	API 17K
	Ocean Rig Mylos	MPO	API 17K
2015	Saipem 10000	Weatherford	API 17K
	Bolette Dolphin	Weatherford	API 17K
	Seadrill West Tellus	Weatherford	API 17K
	Seadrill West Carina	Weatherford	API 17K
2016	Stena IceMax	Schlumberger	API 17K
	Maersk Valiant	AFGlobal / Weatherford	API 17K
	Seadrill West Capella	Weatherford	API 17K
	Maersk Explorer (Heydar Aliyev)	EC-Drill	API 17K
2017	Stena Carron	Schlumberger	API 17K
	Transocean Deepwater Thalasa	Weatherford	API 17K